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TITLE ENHANCING SURVIVABILITY OF STRATEGIC AIRLIFT ASSETS

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Submitted to the faculty in partial fulfillment of requirements for graduation.

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Shortfalls in strategic airlift capability have been identified and the								
survival potential of these assets in a hostile environment has been examined. The study evaluates various measures that could improve								
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# -PREFACE-

The existing shortfall in strategic airlift capability is well documented. Several studies have demonstrated the aircraft that comprise this already inadaquate system are excessively vulnerable to hostile fire. It is imperative steps be taken to ensure the survival during war of a sufficient portion of the existing fleet to accomplish the minimum essential airlift mission. This study will provide the reader with an awareness of various methods to improve the survivability of strategic airlift aircraft.



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# -ABOUT THE AUTHOR-

The author, Major Robert D. Olson, is a Flight Examiner Navigator with more than 3900 flying hours in the C-141 aircraft. He also served as the Tactics Officer for the 446 Military Airlift Wing (Associate) where he developed the wing combat aircrew training program. While developing this program, the author began to explore various means to improve the survivability of strategic airlift aircraft, which is the subject of this paper. Major Olson has completed a Master of Arts degree at Western Washington University and is a 1981 graduate of Squadron Officer School. He has also attended both the Military Airlift Command's Airlift Operations School and Combat Aircrew Training School.

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# **EXECUTIVE SUMMARY**

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### REPORT NUMBER 88-2025

AUTHOR(S) MAJOR ROBERT D. OLSON

TITLE ENHANCING SURVIVABILITY OF STRATEGIC AIRLIFT ASSETS

I. <u>Purpose</u>: To provide the reader with an awareness of various methods to improve the survivability of strategic airlift aircraft in a hostile environment.

II. <u>Problem</u>: The existing shortfall in strategic airlift capability is well documented. Several studies have demonstrated the aircraft that comprise this already inadaquate transportation system are excessively vulnerable to hostile fire. It is imperative steps be taken to ensure the survival during war of a sufficient portion of the existing fleet to accomplish the airlift mission.

III. <u>Data</u>: The ability of airlift to rapidly deploy and resupply combat forces is critical to successful mission accomplishment of most US ground and air forces. Unfortunately, the US possesses less than half of the airlift necessary to satisfy identified mission essential lift requirements. Furthermore, several studies have shown airlift attrition may be substantially higher than the official estimate of 33% within the first 180 days of a NATO/Warsaw Pact conflict. Developments in several areas could improve airlift survival potential, however. First, current airlift doctrine is spread over three seperate volumues. They do not

# **CONTINUED**-

agree with one another and do not reflect changes in other military doctrine that will drive airlift missions. Consolidation and update of airlift doctrine may improve airlift survivability by improving understanding of the proper use of airlift in today's environment. Second, equipment modifications and additions to airlift aircraft that could improve survival potential have been identified and should be implemented. Third, the new Combat Aircrew Training program promises to improve aircraft and aircrew survivability, but academic and flying training events are too infrequent to provide adaquate aircrew proficiency. Finally, the Airlift Master Plan fails to provide an airlift force that will meet projected requirements and calls for airframe retirements that may be counterproductive.

IV. <u>Conclusions</u>: The airlift shortfall and the low survivability of airlift aircraft will have a negative impact on many military operations that depend on airlift for rapid deployment and could effect the outcome of war. These problems must be corrected.

V. Recommendations: The Air Force must implement the following changes to improve airlift survivability and maintain lift capability. First, airlift operational doctrine needs to be reviewed and updated. Second, specific intertheater airlift requirements must be studied in detail and collected in a single document, as has been done for intratheater requirements. Third, the recommendations of the Military Airlift Survivability Study should be implemented. Fourth, alternatives to the airframe retirements without replacement proposed by the Airlift Master Plan should be explored. Finally, the Combat Aircrew Training program should be expanded to include annual ground refresher training and greater combat realism in flying sorties.

#### Chapter One

#### INTRODUCTION

To ensure sufficient lift capability exists to meet both deployment and sustainment requirements for all levels of potential conflict anywhere in the world, the Department of Defense (DOD) oversees an extensive transportation system that includes ground, sea and air transportation elements. These elements are being unified under the new US Transportation Command (USTRANSCOM), and the system is expected to be much better organized and efficient (5:1). The wartime mission of this system is twofold: transport required equipment and personnel from points of origin to final destinations in the combat theater or theaters and complete the transportation process within situation dependent time constraints. Various studies have argued that each of the elements of this system possess deficiencies that would make it difficult, if not impossible, for the system to meet the critical closure times required in certain major theater operations.

Because the nature of conflict may take many forms, along an spectrum of intensity from response to terrorist activities to total war, and because US interests are global nature, the transportaion system must also be very flexible (16:60). The system may be required to support US involvement over great distances such as to Europe or Korea, and may be required to carry enormous quantities of men and materials support of major theater operations. Unless all or most of the men and equipment are already in place at the outset of hostilities, the transportation system may require a significant surge capability to meet deployment requirements. And, as a Library of Congress study has shown, "deploying US Forces without being able to sustain them could sow the seeds of disaster" (17:18). Rapid response may also be required not just for waging war but also for deterring it. "If potential enemies can be shown clearly that the reaction time of this nation's combat forces is so quick that launching an attack will not be worthwhile, then they will not launch such an attack . . . thus, the credibility of our deterrent capacity is greatly enhanced by airlift [the most rapid element of transportation] (16:1). meet DOD requirements, then, the transportation system must be flexible, encompass all transportation elements, possess a network that covers all phases of the transportation requirement from origin to destination, meet both surge and sustainability requirements, permit timely power projection and possess sufficient lift capacity to meet these requirements. Before the required lift capacity can be determined, however, the amount of personnel and material to be lifted must be determined.

An unlimited conventional war in Europe would probably generate heavier US transportation tasking than would war in any other single theater, therefore that scenario is typically used to determine total transportation requirements for all conflicts. Dozens of mobility studies have been conducted since 1975 to determine actual mobility transportation requirements for this and other scenarios. Perhaps the most significant of these was the Congressionally Mandated Mobility Study (CMMS) published in 1981, which mentions 16 of its predecessors. The task of this study was "to determine the mix of airlift, sealift and prepositioning which would provide an acceptable US response capability for military contingencies in the 1990s." (15:III-2).

CMMS looked at four scenarios including a The conflict. The CMMS scenario generating the most transportation requirements was an invasion of Saudi Arabia followed by an invasion of NATO. The CMMS evaluated the requirements of four scenarios against the 1986 baseline force structure and two alternative mobility enhancement programs (15:III-3). Program A increased the existing 45 million ton miles per day (MTM/D) of strategic airlift capability to 66 MTM/D, increased dedicated roll on/roll off (RO/RO) shipping capability to 100,000 tons and prepositioned 130,000 tons of munitions and supplies in Southwest Asia (SWA). Program B increased strategic airlift capability to 81 MTM/D and RO/RO capacity to 170,000 tons. The CMMS concluded that neither program satisfied all unit closure requirements but recommended program A as being more cost effective (15:IX-21). Million ton miles per day (MTM/D) is the average amount of material (in millions of tons) transported over a given distance (in nautical miles) each day on a continuous basis. It is used as a standard for measuring strategic airlift capability because it reflects not only the amount of material lifted but also how fast it can be delivered, and speed can be a very important factor to the ground commander trying to assemble his forces to repel an attack.

Generally, the studies cited therein agree with the CMMS that the present system cannot meet projected lift requirements. This sentiment is echoed in many other mobility studies which variously point out deficiencies in particular transportation modes but generally concur that all phases of the system need improvement. For instance, one study sponsored by the Association of the US Army points out glaring deficiencies in our rail transportation capability — a crucial delivery system for prepositioning sealift shipments that "could not perform satisfactorily during an all-out military mobilization" (19:210). It also suggests that while the strategic airlift capability may be in the best shape this capability also needs improvement

(19:21). While the present study will deal with aspects of the strategic airlift shortfall only, it is important to remember that airlift is only one component of a transportation system, and that each component of that system has identified deficiencies which could negatively impact the other components by requiring them to make up its shortfalls.

As just mentioned, this study will examine only the stategic airlift element and will demonstrate that not only is the force structure available now and proposed for the future unable to meet anticipated strategic airlift requirements but that it also lacks the ability to survive in the environment in which it is expected to operate. Various elements of airlift doctrine, performance characteristics, equipment, training and operational procedures will then be examined to determine ways that the survival potential of these assets might be improved. As it will be demonstrated, airlift is a critical component of this nation's ability to project military power and the survivability of this asset must be ensured if the United States is to meet its wartime commitments.

#### Chapter Two

#### THE PROBLEM

#### STRATEGIC AIRLIFT REQUIREMENTS

Program A of the CMMS recommends a minimum strategic airlift capability of 66 MTM/D while recognizing potential deficiencies in even that level of capability. Nevertheless, 66 MTM/D has become a standard by which to judge airlift capability and is now the stated target of the Airlift Master Plan (AMP). outlined an ambitious program to meet this goal that included many ongoing programs such as the C-141 stretch and enhancement of the Civil Reserve Air Fleet (CRAF) as well as acquisition of It has been pointed out that these "improvements have [already] increased our airlift capability from 26.9 MTM/D in 1981 to 39.9 MTM/D [in 1988]" allowing us to meet 60 percent of the airlift goal (43:229-231). The plan also calls acquisition of 210 C-17 aircraft, transfer of some aircraft to the Air Force Reserve Forces to extend their service life and retirement of 180 older C-130s and 54 older C-141s, all by FY 1998 (11:V-7 - V-9). These changes are designed to obtain the strategic airlift goal of 66 MTM/D by FY 1998 and are detailed in Figure 1 (11:V-10). As the Commander-in-Chief Military Airlift Command (CINC MAC) has pointed out, however, "this 66 MTM/D is only a reasonably attainable goal. We will need far more than that" (4:120).

Of course, you never really know how much of a particular force or capability you are going to need to be successful in a war until after the war is over. Prior to the war you have to predict your requirements based on logical assumptions about where, with whom and against whom, the war will be fought. As mentioned earlier, the CMMS predicted that 66 MTM/D may not be enough airlift capability — it is only what can be afforded. In fact, the CMMS predicts, even after equipment for six Army divisions is prepositioned in Europe, lift requirements could reach 479,000 tons for the first 15 days or 112 MTM/D (15:21). Jeffery Record reports the JCS estimate for a 15 day NATO Europe lift requirement is even higher: 150 MTM/D (2:17). These estimates apply to war in a single theater. However, "it is far more likely that [the US] will be required to support widely dispersed forces in many areas of the globe, which will further reduce the already inadequate strategic mobility capability in the main theater" (25:9). Certainly this was true in WWII, and

with Soviet and Soviet client pressure world wide, it could easily be true in a future conflict.

In any protracted war, of course, the vast majority of shipments will go by sea because sealift is much more economical than airlift and has enormously greater lift potential. However, sealift is also much slower than airlift and is not considered able to meet a 15 day closure. In fact, most war plans assume that sealift from the US to distant theaters such as Europe and Southwest Asia (SWA) will not close before 30 days. All of this short term surge requirement then must be borne by airlift assets.

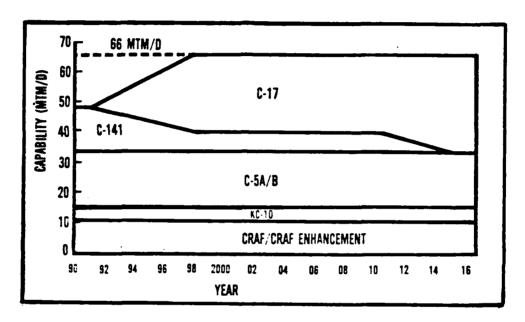


Figure 1. Meeting Intertheater Requirements

Clearly, the identified airlift surge capability required greatly exceeds the capability which is either cur available or proposed under the Airlift Master Plan. difference between airlift requirement and actual capability is called shortfall. The shortfall in any given theater can be alleviated by prepositioning equipment in that theater, but this practice can greatly reduce flexibility and can be Those prepositioned stores are not readily available expensive. for transport to a different theater should the need arise. assets must first be dispatched to retrieve the prepositioned material and then transport it to the new theater. This requires more lift than would direct delivery from CONUS and will also leave a material deficit in the original theater until those prepositioned stores can be replaced. Alternatively, sufficient stores could be prepositioned in every possible theater around the globe to meet every possible contingency. Then, only people would need to be transported. Implicit in the CMMS prepositioning calculations is the realization that the cost of prepositioning everything that might be required initially in every potential theater around the globe would greatly exceed the cost of purchasing additional airlift capability. Additionally, the manpower required to maintain and protect those stores might be prohibitively expensive, and the loss of major portions of those stores to enemy action might be catastrophic.

The point is, there will always be an airlift shortfall because the US cannot afford to meet all of its requirements. This makes airlift a scarce and therefore critical resource, every airlift aircraft a precious commodity. Scarcity of a critical resource requires creativity and husbandry in the application of that resource because excessive loss of it may jepordize every operation that depends upon the resource. On airlift, the early sustainment of virtually every land and air based means of waging war overseas is dependent. This dependency has caused one instructor at the Tactical Fighter Weapons School at Nellis AFB to quip, "Stop the airlift -- and you stop the war!" (32:--). For this reason, every effort must be taken to ensure that the number of airlift aircraft lost to enemy fire or operational hazards is kept to a minimum. The only way to completely protect them is to keep them on the ground and out of for their intended purpose. Some risk must be accepted if these aircraft are to be used but, as General Carlton, a former MAC Commander, has pointed out, "the relative scarcity of airlift resources has a very profound effect on the degree of risk acceptable for the force to absorb. For example, the loss of even a few C-5s would make a serious dent in total strategic capability" (20:8). Therefore, the level of risk must be limited to sustain airlift fleet levels adequate to continually meet requirements.

#### AIRLIFT SURVIVABILITY

It might be argued that survivability of strategic airlift is not a critical problem. After all, during the eleven year period from 1962-1973, the US lost only 61 airlift aircraft to enemy action and these were all tactical not strategic airlift aircraft (23:16). Two issues must be addressed in this regard.

First, strategic airlift was protected during the Vietnam war because it was seldom exposed to the threat. The amount of time spent "in-country" was limited and only secured airfields were used by these aircraft, while tactical airlift aircraft ranged further forward. In future wars, this may not be the case. Doctrinal changes about how and where the Army intends to fight may force changes in the environment in which these aircraft will be forced to operate (13:46-47; 14:2-3, 14-20).

Additionally, the merging of strategic and tactical airlift missions, of which more will be said later, will influence the survivability of these assets.

Second, the relatively low attrition experienced by the tactical community was the result of operating in a relatively low threat environment. There were exceptions such as at An Loc and Khe Sanh, but generally the density and lethality of the threat made avoidance a viable tactic. The enemy air defense environment in a future war is expected to be much more dense and many times more lethal.

A number of studies have determined the survivability potential of airlift assets in this environment. The latest, and perhaps most comprehensive, is the Military Airlift Survivability Study (MASS) (U). The findings of these studies are generally classified but have raised considerable concern over MAC's ability to perform its mission without suffering unacceptable levels of attrition. In fact, during a NATO war "the Air Force predicts a loss of about one third of [the strategic airlift fleet] within the first 180 days . . . based on the confident assumption that NATO would be able to achieve effective air superiority" (19:6). Even this may be an acceptable loss rate since "once the surge period of deployment is over, sustainment requirements for [strategic] airlift are unlikely to exceed 35 MTM/D" (29:31), and theoretically 44 MTM/D of capability would still exist.

This estimate is based on a number of assumptions, however. First, only losses to enemy action are counted in this estimate. Yet the 61 such losses in the Vietnam War were only a part of the total of 126. The rest were due to "operational causes" (23:16), which can be expected to occur in a future war as well.

Second, effective air superiority is assumed but cannot be assured. Air Force doctrine recognizes the influence air superiority will have on all other operations and gives high priority to counter air operations designed to achieve superiority over any enemy air threat (7:1). It must be remembered, however, the struggle for initial air superiority will occur while airlift assets are bringing the men and materiel to support 55 deploying fighter squadrons into the European theater. In other words, during the initial deployment phase, when airlift is most critical, the fighter assets designed to achieve air superiority will be understrength and struggling to overcome an all out enemy attack. It is reasonable to conclude, then, that "complete airspace superiority could not be established prior to airlift operations" (24:38), and it would be virtually impossible to provide comprehensive protection for airlift assets in the theater. The implications of this problem are illustrated in the German Luftwaffe experience of Operation Barbarosa where nearly 500 transport aircraft and almost 1,000 of

the most experienced aircrew members were lost to hostile fire and other operational causes between November 1942 and January 1943 (26:195). As General-Major Fritz Morzik points out "a key element in these losses was the shortage of fighter aircraft making it impossible to escort transport missions" (26:127). Without effective air superiority, then, losses may be significantly higher than the prediction of 30% in 180 days.

Third, the implicit assumption is made that airlift losses transiting to and from the theater will be negligible. The German experience over the Mediterranean in April 1943 casts doubt on this assumption too. During an intertheater mission to North Africa, a flight of 90 Junker transports and escorting ME-109 fighters was intercepted by fifty P-40E Warhawks. Despite the transports wave hopping tactics sixty transports and sixteen ME-109s were destroyed -- a 67% loss rate (1:61-63). With surface to air missiles on board Soviet ships in the Atlantic Ocean and long range patrol aircraft capable of reaching the air lines communication (LOCs), this assumption may not be valid. Furthermore, since the Soviets have a large and highly mobile force that appears, at least to this author, to be designed to achieve victory before the US can get additional assets into the theater, stopping the airlift flow may be a higher Soviet priority than anticipated, and limiting airlift losses during ocean transit may be very difficult.

Fourth, a single theater of operations is assumed. The wisdom of this assumption has already been addressed. It is far more likely that airlift surge and/or sustainment capability may be required in two or more theaters simultaneously, as was the case in World War II (25:9). The airlift capability in any given theater would then be reduced and each available aircraft that much more critical to the success of theater operations.

Clearly, the US airlift posture is not what it should be. A fiscally constrained goal of 66 MTM/D of stategic airlift capability has been established. That goal will not be reached before fiscal year 1998, and is widely recognized as being insufficient to meet all or even most of the anticipated lift requirements. Furthermore, sufficient aircraft may not be capable of surviving hostile fire to permit even that goal to be achieved and maintained during the first critical weeks of a major war. Since the purchase of airlift assets, over and above those required to meet the 66 MTM/D goal, is not anticipated, it is absolutely imperative steps be taken to improve the survivability potential of those assets that are existing or planned. Succeeding chapters in this study will explore means of improving that survivability potential.

#### Chapter Three

#### DOCTRINE AND REQUIREMENTS

#### AIRLIFT DOCTRINE

Current Air Force operational doctrine makes a distinction between the roles of strategic and tactical airlift and, in fact, the doctrine covering them is published in two separate manuals. AF Manual 2-4, Tactical Airlift stipulates:

Tactical airlift forces are manned, equipped, and trained to perform airborne operations for the delivery of combat forces directly into an objective area, both during and subsequent to the assault phase of an operation; to perform those airborne operations which provide for the relocation of forces within and from a combat area; and to perform air logistic operations in support of all theater forces, including those engaged in combat operations (8:1).

AF Manual 2-21, USAF Strategic Airlift, however, indicates the function of "strategic airlift is the continuous or sustained air movement of units, personnel, and material in support of all Department of Defense (DOD) agencies; between area commands, between the Continental United States (CONUS) and overseas areas, and within an area command when directed" (10:1).

In other words strategic airlift will generally operate to and from a theater or theaters of operations (intertheater) while tactical airlift will generally operate within a given theater (intratheater). AFM 2-21 goes on to imply that strategic airlift assets will generally remain outside of the combat zone by charging MAC with the responsibility for the "operation or arrangement for the operation of air terminals at aerial ports located in overseas areas outside the combat zone and forward areas at which strategic air logistics support operations constitute the predominate use" (10:2). The manual also defines combat zone as territory forward of the Army rear boundary and forward area as an area in proximity to combat (10:2). Airlift requirements in these areas will be supported primarily by tactical airlift assets.

While a distinction is made in terms of functions, the doctrine charges both strategic and tactical assets with the

responsibility to augment each others functions as required (8:3, AX:1). To facilitate this augmentation role the C-5 and the C-141 aircraft, primarily strategic assets, possess both an airland and an airdrop capability. Additionally, the C-5 was designed to operate on semi-austere airfields, while some C-141s were equipped with an adverse weather, formation, aerial delivery capability and a portion of the C-141 crew force (commonly called tactical crews) maintains airdrop qualification proficiency. Furthermore, the C-17, when acquired, is expected to operate in a direct delivery mode -- functioning as a strategic/tactical airlifter on a regular basis, blurring the distinction even more (30:II-9). This blurring is a deliberate reaction to a recognized need. As the current Commander-in-Chief Military Airlift Command has stated:

When an airlift force supports a commander, airlift cannot be thought of as an airplane: it is a system that includes a variety of airplanes. With this understanding, the classic distinctions between tactical and strategic airlift become blurred. It is not a matter of a few airplanes, or a type of airplane for a given theater. It, indeed, is a system of airplanes that can be used across the entire spectrum of conflict (4:122).

While this blurring or blending of operational functions does not necessarily pose any grave doctrinal difficulties it does suggest that the current doctrinal manuals should be reviewed and perhaps rewritten. Airlift is a capability that can, within certain constraints, deliver a payload from a point of origin to a point of final destination. Intertheater and intratheater lift are merely subsets or portions of the total airlift capability. There are typically some operational differences in the two types of missions. For instance, intertheater missions typically cover greater distances than intratheater missions, while the later frequently require operations from austere airfields with shorter runways. These mission differences may place differing demands on aircraft performance characteristics, and aircraft designed for optimum performance of one mission may not perform as well for another mission. This is why in the past different aircraft types were purchased to perform different airlift missions, and separate doctrinal manuals were written.

If new technological capabilities, and operational requirements, however, are resulting in an airlift fleet where various aircraft types will have overlapping capabilities and responsibilities that cut across traditional mission divisions, then present doctrine must be carefully reviewed to ensure that those changes do not violate sound doctrinal principles.

If it is determined that modification of the doctrine is appropriate, then those changes should be made. If, on the other hand, it is determined that these new mission concepts do violate the fundamental principles of sound doctrine, then those changes must not be enacted no matter how attractive they may be financially. It must be remembered that it is operational doctrine that describes "the proper use of aerospace forces," (12:vi) and not aerospace forces that describe the proper use of doctrine. Such a review is long overdue, since AFM 2-4 was published in 1966 and AFM 2-21 in 1972. In any case, this doctrinal review must be done before new assets, such as the C-17, are operational and before existing assets undergo any more modifications. This review must also be accomplished within the context of any changes to airlift mission requirements caused by other doctrinal changes such as the new Airland Battle doctrine.

#### AIRLIFT REQUIREMENTS

The wartime mission of the Military Airlift Command is to "provide integrated airlift resources on a global basis to deploy and employ combat forces and their equipment and to resupply those forces once in place" (30: II-2). Airlift assets then, are acquired, operated and maintained to meet the requirements generated by DOD users. In Chapter One, the total identified strategic airlift requirement, expressed as millions of ton miles per day (MTM/D), was described. This measure reflects total lift requirements generally, and does not describe the details of the required lift characteristics. That information is situationally dependent and, if an appropriate war plan exists for a given situation, can be found in the Time Phased Force Deployment Data (TPFDD) associated with the war plan. That data is only as good as its war plan and remains valid only as long as the plan is followed. Currently no other measure of strategic airlift requirements exists.

The tactical airlift community, on the other hand, operates under different criteria because they generally do not fly the greater distances associated with strategic missions. That force is sized to provide a capability to lift a given amount of weight expressed as tons per day or T/M. This too is a gross measure of required lift. It does not describe what is required in terms of actual operating characteristics and performance capabilities. In an effort to understand the specifics of these requirements, the Airlift Concepts and Requirements Agency (ACRA), a joint agency of the Army Training and Doctrine Command (TRADOC) and the Air Force Military Airlift Command (MAC) staffed by experts all phases of airlift operations, has developed a Qualitative Intratheater Airlift Requirements Study (QITARS). This study was completed in 1985 and explains in detail "the wartime missions which will be required of Air Force intratheater airlift and the capabilities which the airlift force must have in order to accomplish those missions" (18:i).

The QITARS study does not answer all questions about intratheater airlift requirements, but it does identify specific missions to be performed and establishes criteria for those missions. For instance, a requirement to drop container delivery system (CDS) bundles in good or bad weather to within 50 meters of the desired point of impact has been identified, because "units receiving CDS airdrops are often foot mobile, closely engaged with enemy forces, or operating in rugged or heavily vegetated terrain. Clearing a large DZ is often impossible and securing a bundle dropped 200-400 meters away could be very time consuming or impossible" (18:IV-52). The airlift support of the beseiged marines at Khe Sanh in 1968 is an example of the kind of situation envisioned for this requirement.

This kind of detailed data will enable airlift force planners and key decision makers to develop an intratheater airlift force that possesses the capabilities and characteristics required to meet the user's needs. A study of this type should be undertaken to help identify similar requirements for intertheater airlift assets. Planners and decision makers must ensure the strategic airlift fleet also meets user requirements. It is ironic "airlift aircrew publications do not emphasize user satisfaction as a parameter for determining mission accomplishment" (29:12) when user requirements provide the mission purpose. Along the way, anticipated user requirements should be collected, collated and studied to give planners and decision makers the detailed data they need to make rational decisions concerning the nature, structure and characteristics of the airlift fleet.

Such a study should attempt to assess all potential uses of strategic airlift resources as part of a total airlift system. For instance, use of these assets in a maritime resupply mode and as tactical mission augmentation should be addressed. How many of these aircraft really need to be configured for airdrop capability and what is the requirement for forward area delivery of outsize cargo?

A recent study by Major Richard Heffner surveyed 22 staff agencies identified by the Airlift Concepts and Requirements Agency as having "responsibility for determining AirLand Battle's airlift requirements and capabilities" (24:9). The Army and Air Force responses to this survey "revealed that . . . the AirLand Battle operation requiring the most airlift support was the close operation . . [and] a medium threat contingency theater was the global environment where airlift support could contribute most successfully to AirLand Battle operations" (24:22). For purposes of this study a medium threat was defined as:

An air defense threat characterized by small arms, optically aimed AAA > .51 caliber and man transportable,

shoulder fired weapons. . . . [and] may include more sophisticated air defense systems employed in a dispersed pattern making their avoidance possible with proper defensive equipment or tactics being employed (24:54).

Operation in this medium poses several questions concerning tactics and equipment requirements. If this is, as the study suggests, an environment where airlift can make the most significant contributions, then at least a portion of the airlift force should be configured to operate, if possible, in this medium. The classified survivability studies mentioned earlier provide detailed data on survival probabilities in this medium but they don't address the requirement to operate therein; how much airlift of each type, bulk, oversize and outsize will be required, how often will strategic airlift assets need to be used, and how often will delivery methods such as airdrop and extraction be employed are just some of the questions to be addressed. Rational decisions on force modernization can only be made after the specific requirements have been determined.

If planners and decision makers can be certain they have sound, appropriate doctrine and detailed, accurate requirements data to guide their decisions, then they can structure a force that is appropriate to user needs and can, with proper equipment, crew training and operational procedures survive in its intended environment. These topics will be discussed in subsequent chapters.

#### Chapter Four

#### **EQUIPMENT**

According to the Military Airlift Survivability Study (MASS), "The [strategic] general airland fleet will face an enroute threat from naval surface combatants, from terrorism and from unconventional warfare forces, from fighter interceptor aircraft, and from strategic surface-to-air missiles . . . [and] a terminal threat from terrorism or unconventional warfare forces when landing or taking off" (30:3). The purpose of the MASS was to study the survivability potential of the C-5, C-141 and C-130 aircraft when confronted by weapon systems characteristics of the above threats. The actual results reported in the MASS are classified. These aircraft, as presently configured, were shown to have far less than desirable survivability potential against those threats.

This is not a new revelation; it confirms the data obtained from several previous studies, and suggests the Air Force estimate of a loss of one third of the airlift fleet in the first 180 days of conflict may be rather optimistic. What is new and important about the MASS is that detailed recommendations involving specific systems or additional testing requirements were made. Some of the recommendations reported in the unclassified portion of the executive summary are detailed in Figure 2 (30:43-44).

The MASS analysis studied the effects of certain threats and recognized the potential level of threat to strategic airlift systems. If the doctrine review and requirements analysis detailed in Chapter Two are completed and the results are compared with future intelligence estimates, then specific data on threat potential can be generated. That data, combined with the results from both the MASS and follow-on studies, can be used to determine very specific equipment requirements. In a fiscally constrained environment, this information will be crucial in determining how to provide the best possible defense for the fleet given available assets.

It is important this information be determined very soon for two reasons. First, the US will remain critically short of airlift until the C-17 fleet is operational. In the interim, there is an urgent need to provide enough protection for the C-5/C-141 fleet to ensure sufficient airlift capability will

continue to exist so that minimum essential war time tasking can be meet. Second, systems costs for the C-17 fleet must be considered. Modifications to existing airframes are generally more expensive than those to aircraft in production. "If, for instance, multiple configurations for the C-17 are indicated, it would be cheaper to do these during production" (21:29). Additional savings can be realized through commonality of systems. That portion of defensive systems which can be made common among the C-5, C-141 and C-17 should be determined before the C-17 goes into production. Commonality factors should also be determined for future communications equipment.

#### C-141

- 1. Fuel system inerting (urgent)
- 2. ALE-40 family chaff dispenser flight test
- 3. Determine chaff-maneuver capabilities
- Install missile warn, expendable, radar warn suite (SKE only) if identified by chaff test
- 5. Anti-terrorist Missile Warn/Flare suite (non-SKE)
- 6. Consider Threat Avoidance Radar if developed for C-130

C-5

- 1. Operational cargo hold fire extinguisher system
- 2. Anti-terrorist Missile Warn/Flare suite possible
- 3. Consider Threat Avoidance Radar if developed for C-130

Figure 2. MASS Recommendations

Because of the critical and immediate demand for airlift support of certain combat forces, it is unlikely that "complete airspace superiority could be established prior to airlift operations. Therefore, airlift aircraft must be able to communicate with US ground and air forces involved with establishing air superiority to improve the survivability of airlift operations" (24:38).

Defense of airlift assets near the forward edge of the battle area (FEBA) is a complex undertaking. For instance, airlift's success in supporting the isolated outpost at Khe Sanh against strong enemy resistance was possible because of "the 24,654 fighter and bomber missions which dropped over 98,000 tons of bombs in support of the battle" (23:16-17). In future wars these assets will be joined by ground based artillery, missiles, rockets and electronic jammers for coordinated, joint suppression of enemy air defenses (J-SEAD). This will greatly compound the coordination and communication task facing airlift aircraft conducting forward operations. For example:

In the area where the FLOT (Front Line of Own Troops) is to be penetrated, Army artillery may be more effective in the suppression of enemy air defenses (SEAD) than tactical air. Direct support artillery fire on all suspected air defense sites, as well as area fire on the penetration corridor to the maximum range of friendly fire should be coordinated for both ingress and egress. If the threat is high, consideration should be given to shifting the fire to the shoulders of the corridor rather than terminating when the aircraft enters (22:17).

This concept will require airlift to fly a profile that is compatable with the arc and firing parameters of the artillery to avoid fratracide. Mission details must be carefully coordinated beforehand. If this coordination cannot be done during mission planning it will need to be done while airborne. That will require communication between the aircraft and the artillery batteries, either directly or through a third party such as the Airborne Command and Control Center (ABCCC). Changes and delays would also need to be coordinated to ensure corridors are available during the new transit times, thus increasing the need for communications. This communication should also be encrypted to deny the enemy information about mission details. This example uses only Army artillery in the SEAD role. Similar communications would need to be established with anyone performing the SEAD mission, however -- whether ground or air based, US or allied forces.

This requirement may not be limited to a few cross FEBA airlift missions either. On the shifting and dynamic battlefield envisioned by Colonel Figgins (22:17) and Lieutenant Colonel Dickman (21:40-41), where clear and distinct engagement lines are lacking, any airlift mission forward of the corps rear area may require this kind of support and need to communicate with J-SEAD assets.

The ability to communicate will be critical to mission success and survival in a combat environment. Headquarters MAC must ensure airlift aircraft are capable of communication with all forces engaged in the J-SEAD mission to further enhance the survivability of this critical transportation resource. Along with the improvements to doctrine and equipment already discussed, training improvements should also be considered.

#### Chapter Five

#### TRAINING

The Military Airlift Command is placing increasing emphasis on a program called Combat Aircrew Training (CAT). Approximately five years ago a Combat Aircrew Training School was established at Nellis Air Force Base to produce a cadre of qualified instructors for use in unit training programs. Early in 1987 CAT requirements were incorporated into the appropriate 51-series training manuals for strategic airlift aircrews; MACR 51-130, saw this change a couple of years earlier. And, beginning in March 1987, all MAC active duty and MAC gained reserve flying units were required to implement local training programs.

It is too soon to evaluate the long term effectiveness of this new program, though it is hoped, through it, crew members will receive the skills they need to survive in combat. The program as outlined in MACR 51-141, C-141 Aircrew Training, consists of two phases -- ground training and flying training. The ground training phase, according to Table 4-1 of that regulation, is a one time requirement and "should incorporate all combat related aircrew training units and provide the experience necessary to plan for the units' combat mission" (6:10). The flight training, which must include as a minimum "an intelligence briefing, mission planning (ingress, objective area, egress, support, communications plan, alternate plan, and evasion plan of action), chart preparation, and aircrew mission study" before the flight, is a semi-annual requirement (6:10,26).

The implication in these requirements, of course, is a crew member can learn everything he needs to know about flying in combat during a one time class (usually included as part of weeklong block training). It is also so easy the crewmember can stay proficient by doing it twice a year (once a year if he is a reservist) (6:26-27). The validity of this assumption has been questioned, however.

Conversation with an instructor from the MAC Combat Aircrew Training School revealed that faculty expected the 51-series manuals to reflect a requirement for annual ground refresher training as well as initial training (31:--). As the MAC experts in Combat Aircrew Training, they feel aircrew members need more in-depth training than the program currently provides. Annual refresher training would seem a reasonable requirement and should

be incorporated. However, while repetition can be a useful training device at times, this training should not only refresh concepts previously covered but should also incorporate discussions of the latest tactics and techniques that have been developed. HQ MAC/DOXT should develop a crossfeed program to facilitate this process. That way every unit will know what tactics are current and good ideas can be shared.

Fiscal constraints will probably preclude an increase in the CAT sortie requirements, but more CAT training can be generated by increased combat realism in all training exercises and Operational Readiness Inspections. The movement made by the MAC/IG away from criteria oriented grading and towards results oriented grading should greatly facilitate this process.

In sum, the initial steps made by MAC in the field of combat aircrew training are encouraging and long overdue. This program must be carefully monitored to ensure its success and the general movement should be towards increased combat realism. Along with training, however, operations must also be considered.

#### Chapter Six

#### **OPERATIONS**

The Airlift Master Plan (AMP) calls for the acquisition of 180 primary assigned C-17 aircraft (PAA) by fiscal year 1998 while retiring 180 PAA older C-130s and 54 PAA older C-141Bs (11:V-8). This would yield the recommended force structure outlined in Figure 3 (11:V-8), which includes: 180 PAA C-17s, 114 PAA C-5s, 332 PAA C-130s, 180 PAA C-141s and 41 PAA KC-10 aircraft, for a total of 847 military aircraft in the airlift The recommended structure will retain 11.3 MTM/D of system. cargo lift capability in the Civil Reserve Air Fleet while increasing the military strategic airlift capability to 54.7 MTM/D thus meeting the 66 MTM/D goal by FY 1998, see Figure 1, in chapter 2. This structure is to remain stable until FY 2010 when retirement of the remaining C-141 fleet is begun (Figure 3), and 40 PAA additional C-17s are acquired to replace them (11:V-9).

Thus, by FY 1998, the C-17 will comprise 35% of MACs 515 PAA strategic airlift aircraft and, by FY 2015, the 220 PAA C-17 fleet recommended by the AMP will comprise 57% of a strategic airlift fleet that will have dwindled to 375 PAA aircraft. But, "the C-17, as designed and advertised, will conduct [both] inter and intratheater airlift" (27:30), and, under the AMP, the 220 C-17s added to 332 PAA C-130s will comprise the total intratheater airlift fleet. Completion of this modernized force structure will bring the total intratheater tons-per-day (T/D) capacity to 15,000 T/D, a 78% increase in capacity (11:V-11). Due to a larger cargo capacity, the C-17 will actually provide 60% of this intratheater capability, see Figure 4. These changes recommended by the AMP, while improving total intratheater intertheater lift capacities, nevertheless, pose two problems that must be addressed.

First, the C-17 may be too large an aircraft to be used efficiently as a tactical airlifter. According to AFM 2-4:

The tactical airlift mission . . . often results in non-scheduled operations, many sorties of short duration, and low aircraft utilization rate: Tactical airlifts' requirements are determined by the developing situation in a theater rather than by ton mile

computations, thereby establishing responsiveness as the governing criteria for an effective tactical airlift force (8: 3).

The low utilization rate, resulting from the need to make sufficient tactical airlifters available (or "on call") to respond to shifting requirements, means that each aircraft may be used inefficiently. This is not a negative characteristic in and of itself -- it is merely the cost of doing the tactical airlift In the case of the dual-role C-17, however, the need business. for responsiveness may dictate the use of a larger number of airframes in the tactical role than their lift capacity versus the T/D requirement might indicate. Thus fewer of these highly efficient aircraft will be available for the strategic airlift Study of this problem is outside the scope of this paper, but should be conducted by competent authority. Specifically, it should be determined if operation of the C-17 in the tactical airlift role will result in sufficient under-utilization of that asset to have a significantly negative impact on accomplishment of the strategic airlift mission. If so, perhaps acquisition of a different aircraft to augment existing tactical airlift aircraft is indicated.

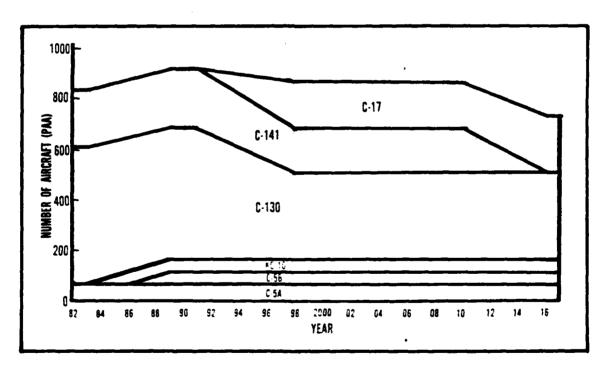


Figure 3. Recommended Force Structure

Secondly, the increasing size of airlift aircraft, while improving efficiency may have a negative impact on force survivability.

The larger the aircraft the more lucrative a target it is [because of its increased payload]. This applies either to ground-to-air or air-to-air interception. . . With each combat loss of our present day aircraft, we are losing a larger percentage of airlift capability. The larger the airframe [and the smaller the fleet] the larger is that percentage loss. . . Thus from a military practicality standpoint, increased size dictated purely by cost effectiveness considerations can be self defeating (21:26).

Lieutenant Colonel Dickman's comments were made in 1973 in response to the then current fleet modernization with C-5s and C-141s, but their message is equally applicable today with increases to the C-5 fleet occuring and acquisition of the C-17 anticipated. Previous chapters in this study have addressed the hostile nature of the environment to which these aircraft may be exposed and the high loss rates to enemy fire anticipated. As the number of aircraft lost begins to climb, the decision to expose each additional aircraft to the threat may become, as General Carlton has suggested, increasingly difficult. Yet, failure to risk these dwindling assets may have catastrophic consequences for engaged combat forces. The criticality of each airframe loss in combat is increased by peacetime decisions that decrease the number of aircraft in the fleet.

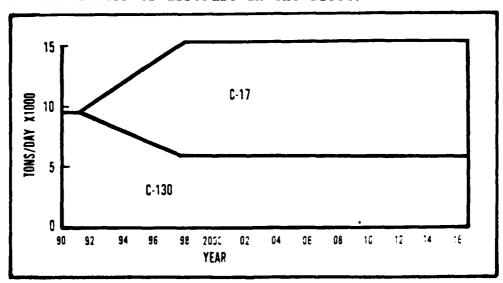


Figure 4. Meeting Intratheater Requirements

To place this problem in perspective: "As the ground threat escalated to a moderate level at An Loc in the spring of 1972, in a matter of days five C-130s had been lost and 58 had been damaged" (28:20). If the airlift force of 1998 recommended by the AMP were to take similar casualties amongst C-17 aircraft then 17.2% of the tactical lift potential and 12.2% of the strategic airlift airframes would be affected. In this regard, the AMP recommendation to retire 54 PAA C-141s and 180 PAA C-130s without replacement must be carefully evaluated. While such a decision may be cost effective in peacetime it may prove to be very costly in war. Methods of maintaining some of these aircraft as spares to replace attrited aircraft should be explored. Extending their service lift and/or reducing their utilization rate will help insure the continued serviceability of assets that have already been acquired. Increasing the number assigned to each Air Reserve Forces flying unit possessing or programmed to possess these aircraft may be a possible solution. Maintenance costs in each unit may be higher and space allocations greater, but the wartime fleet sustainment thus purchased may be well worth the price. In any case, the subject should be explored. This study has examined various methods to improve the survivability of strategic airlift aircraft and the final chapter will provide conclusions and recommendations based on that examination.

#### Chapter Seven

#### CONCLUSIONS

The US Air Force does not possess sufficient airlift meet all identified capability to airlift requirements. if all of the force enhancements recommended in the Furthermore. Airlift Master Plan are implemented, there will still be a Survivability of the existing fleet, therefore, is a issue. Unfortunately, current capabilities critical procedures are incapable of providing sufficient protection for the airlift fleet and attrition of this critical resource is expected to be quite high. This could have a negative impact on many military operations that depend upon airlift for rapid deployment and resupply and could effect the outcome of war. The Air Force must implement several changes to improve airlift survivability to maintain lift capability.

First, airlift operational doctrine needs to be reviewed and updated. The existing manuals on doctrine were written during the Vietnam War -- long before the Military Airlift Command was made the single operating agency for all airlift, and they contain statements that do not support existing command, control and operating procedures.

Second, there is no single source that clearly describes the nature and amount of various airlift characteristics and operating capabilities needed to meet existing and anticipated future strategic airlift requirements. Consequently, war planners and key decision makers do not have a valid yardstick to measure the ability of strategic airlift assets to meet these requirements. Such a yardstick needs to be developed. Without it decisions concerning the use of those assets and the kind of defensive equipment they may need will be less than optimal.

Third, the recommendations of the Military Airlift Survivability Study should be implemented. Some programs such as the C-141 fuel system inerting program are clearly necessary. The results generated from the further studies recommended coupled with data from the study called for above should give a clear picture of how much and what kind of measures are needed to provide adequate protection to the fleet.

Fourth, the Airlift Master Plan recommendation to retire without replacement 180 PAA C-130s and 54 PAA C-141s should not be implemented. Rather, some method of retaining these aircraft

as operational spares should be explored. In a protracted war, high levels of attrition in the airlift fleet can be anticipated and rapid generation of replacement aircraft may be required. These aircraft could serve that function very well if they were maintained in an operationally ready state.

Finally, the recent emphasis MAC headquarters has placed on Combat Aircrew Training should continue, and Operational Readiness Inspections and training exercises should strive for greater combat realism. The more the aircrew's training resembles actual combat conditions the more prepared they will be for that experience, and the greater will be their chances for survival.

The airlift system provides vital support to many combat operations and without it, the US warfighting capability would be seriously reduced. That system simply must work, and with proper equipment, training, and operational procedures, standing on the foundation of a strong and vibrant doctrine, it will.

# ·BIBLIOGRAPHY—

#### A. REFERENCES CITED

#### Books

- Mason, Herbert Molloy, Jr. <u>Duel for the Sky</u>. New York: David McKay Company, Inc., 1970.
- 2. Record, Jeffrey. <u>US Strategic Airlift: Requirements and Capabilities</u>. Cambridge, Massachusetts: Institute for Foreign Policy Analysis, Inc., 1986.
- 3. Wragg, David W. <u>Airlift: A History of Military Air</u>
  <u>Transport.</u> Novato, California: Presidio Press, 1986.

#### Articles and Periodicals

- 4. Cassidy, Duane H. "MAC's Moment of Truth." <u>Air Force</u>
  <u>Magazine</u>, September 1986.
- 5. Krisinger, C.J., ed. "Transportation Unified -- The Arrival of TRANSCOM." <u>Airlift</u>, Vol. IV, no. 3 (Fall 1987).

#### Offical Documents

- 6. Military Airlift Command. MACR 51-141: <u>C-141 Aircrew Training</u>. Scott AFB, Illinois: HQ MAC/DOT, 11 February 1987.
- 7. Tactical Air Command. TACM 2-1: <u>Tactical Air Operations</u>. Langley AFB, Viginia: HQ TAC, 15 April 1978.
- 8. US Department of the Air Force. <u>Aerospace Operational Doctrine: Tactical Airlift</u>. AF Manual 2-4. Washington DC: Government Printing Office, 1966.
- 9. ----. <u>Aerospace Operational Doctrine: Tactical Air Operations -- Special Air Warfare</u>. AF Manual 2-5. Washington DC: Government Printing Office, 1967.
- 10. ---- Aerospace Operational Doctrine: USAF Strategic Airlift. AF Manual 2-21. Washington DC: Government Printing Office, 1972.
- 11. ---- Airlift Master Plan. Washington DC: Government Printing Office, 1983.

## CONTINUED.

- 12. ----. United States Air Force Basic Doctrine, AF Manual 1-1. Washington DC: Government Printing Office, 1979
- 13. US Department of the Army. <u>Airland Battle Doctrine</u>, Art of War Colloquium. Carlisle Barracks, Pennsylvania: US Army War College, 1983.
- 14. ----. FM 100-5: Operations. Washington DC: HQ Army, May 1986.
- 15. US Department of Defense. <u>Congressionally Mandated Mobility Study</u>. Washington DC: Government Printing Office, 30 April 1981. SECRET/NOFORN. Classified by Multiple Sources. Declassify on OADR. Unclassified information only used from this source.
- 16. US House of Representatives, Committee on Armed Services.

  Report on the Posture of Military Airlift. Washington DC: Government Printing Office, 1976.
- 17. US Library of Congress. <u>United States/Soviet Military</u>
  <u>Balance</u>. Washington DC: Government Printing Office,
  1976.

#### Unpublished

- 18. Airlift Concepts and Requirements Agency. A Qualitative Intratheater Airlift Requirements Study. Scott AFB, Illinois: 1985.
- 19. Association of the United States Army. <u>Strategic Mobility:</u>
  <u>Can We Get There From Here -- In Time?</u> Arlington,
  Virginia: 1984.
- 20. Carlton, Paul K., General. "Strategic Airlift." <u>Vol III:</u>

  <u>Military Capabilities and Employment</u>. Air War College
  Associate Program, Maxwell AFB, Alabama: 1974.
- 21. Dickman, Henry J., Jr., Lieutenant Colonel. <u>Airlift</u>

  <u>Aircraft Requirements -- Where Are We Going?</u>

  <u>Maxwell AFB, Alabama: Air War College Professional Study, 1973.</u>
- 22. Figgins, Jerry M., Colonel. <u>Implications for Tactical</u>
  Airlift in the <u>Evolving Army Maneuver Doctrine</u>.

  Carlisle Barracks, Pennsylvania: US Army War College, 1984.

## -CONTINUED-

- 23. Gallagher, Michael R., Major. <u>Airlift: The Issues Defined</u>.

  Maxwell AFB, Alabama: Air Command and Staff College
  Research Report, 1979.
- 24. Heffner, Richard P., Major. <u>Airlift Support of Airland</u>
  Battle Doctrine: Focus on Requirements, Capabilities,
  and the C-17. Maxwell AFB, AL: Air Command and Staff
  College Research Report, 1987.
- 25. Larsen, Robert A., Lieutenant Colonel. <u>National Strategy</u>
  <u>Implications of the Strategic Airlift Shortfall</u>.

  Maxwell AFB, AL: Air War College Professional Study, 1983.
- 26. Morzik, A. D. Fritz, General-Major. <u>German Air Force Airlift Operation</u>. Air University Research Center, USAF Historical Division, Maxwell AFB, Alabama: 1961.
- 27. Schaule, Norman, Major. <u>C-17 Pilot Manning: The Need For a Plan Based on Capabilities and Lessons Learned.</u>

  Maxwell AFB, Alabama: Air Command and Staff College Research Report, 1985.
- 28. Stevens, Harvey S., Major. <u>Combat Effectiveness Training:</u>
  <u>Tactical Airlift</u>. Maxwell AFB, Alabama: Air Command and Staff College Research Report, 1979.
- 29. Underwood, David C., Major. The Airlift Lessons of

  Vietnam -- Did We Really Learn Them? Maxwell AFB,

  Alabama Air Command and Staff College Research Report,
  1981.
- 30. US Air Force Aeronautical Systems Division. Military Airlift
  Survivability Study Executive Summary. Wright-Patterson
  AFB, Ohio: HQ ASD/XRS, 15 December 1986. SECRET/NOFORN.
  Classified by Multiple Sources. Declassify on OADR.
  Unclassified information only used from this source.

#### Other Sources

- 31. Hook, Blaine, Captain USAF. Instructor, Military Airlift Command Combat Aircrew Training School, Nellis AFB, Nevada, Telecon 17 March 1987.
- 32. Keller, Mike, Major USAF. Instructor, Military Airlift
  Command Combat Aircrew Training School, Nellis AFB,
  Nevada. Reported comments of Tactical Fighter Weapons
  School Instructors in his lectures, October 1985.

## -CONTINUED-

#### B. RELATED SOURCES

#### Books

- 33. Caidin, Martin. The Long Arm of America. E. P. Dutton and Comapny, Inc., New York: 1963.
- 34. Heilbrum, Otto. <u>Warfare in the Enemy's Rear</u>. Frederick A. Praeger, Publisher. New York: 1963.
- 35. Mason, R. A., Air Vice-Marshal, (ed). <u>War in the Third</u>
  <u>Dimension</u>. Brassey's Defense Publishers, London:
  1986.

#### Articles and Periodicals

- 36. Nuechterlein, Donald E. "National Interests and National Strategy: The Need for Priority." <u>National Security Policy and Process</u>. Maxwell AFB, AL: Air Command and Staff College, 1988.
- 37. Nutting, Wallace W. "Strategic Mibility: A Puzzle Which Must Be Solved." <u>Government Executive</u>, Vol 17, January 1985.
- 38. Patchin, Kenneth. "Strategic Airlift." <u>The United States</u>
  <u>Air Force in Southeast Asia</u>. Carl Berger, ed.
  Washington DC: Office of Air Force History, 1977.
- 39. Paul, John W. "The Thread of Doctrine." <u>Air University Review</u>, Vol 27 (May-June 1976).

#### Offical Documents

- 40. Military Airlift Command. MAC Final Evaluation Report Exercise Reforger 78/79. Scott AFB, IL: Head-quarters MAC, 1979.
- 41. US Congressional Budget Office. <u>Improving Strategic</u>
  <u>Mobility: The C-17 Program and Alternatives</u>. Washington DC: 1986.
- 42. ----. <u>US Airlift Forces: Enhancement Alternatives for NATO and Non-NATO Contingencies</u>. Washington DC: 1979.

# -CONTINUED-

- 43. US Department of Defense. <u>Annual Report to the Congress.</u>
  <u>Fiscal Year 88</u>. Washington DC: Government Printing Office, 1987.
- 44. US Department of the Air Force, Project Corona Harvest.

  <u>USAF Airlift Activities in Support of Operations in Southeast Asia. 1 Jan 65 31 Mar 68</u>. Maxwell AFB,
  AL: Air University, 1973.

#### Unpublished Materials

- 45. Dessert, Donald M., Major. <u>C-X Operational Effective-</u>
  <u>ness in the Intratheater Environment</u>. Fort Leavenworth, KS: US Army Command and General Staff College,
  1983.
- 46. Mills, William H., Major. <u>Consolidation of Airlift</u>
  <u>Navigators Inventories</u>. Maxwell AFB, AL: Air Command and Staff College Research Report, 1986.
- 47. Russo, Peter W., Major. <u>Small and Sure: A New Concept in Theater Airlift</u>. Maxwell AFB, AL: Air Command and Staff College Research Report, 1984.
- 48. Todd, David F., Major. <u>Power Projection Thru Airlift --</u>
  <u>How to Make It Work</u>. Maxwell AFB, AL: Air Command and Staff College Research Report, 1987.

